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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of : **Confirmation No. 1731**

Willem Johannes VAN STRAATEN : Docket No. 2004_0255A

Serial No. 10/779,719 : Group Art Unit 2873

Filed February 18, 2004 :

OPTICAL APPARATUS

CLAIM OF PRIORITY UNDER 35 USC 119

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicant in the above-entitled application hereby claims the date of priority under the International Convention of South African Patent Application No. 2003/9783, filed December 18, 2003, as acknowledged in the Declaration of this application.

A certified copy of said South African Patent Application is submitted herewith.

Respectfully submitted,

Willem Johannes VAN STRAATEN

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June 9, 2004

Sertifikaat

REPUBLIC OF SOUTH AFRICA

PATENT KANTOOR
DEPARTEMENT VAN HANDEL
EN NYWERHEID



Certificate

REPUBLIEK VAN SUID-AFRIKA

PATENT OFFICE
DEPARTMENT OF TRADE AND
INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that

the documents annexed hereto are true copies of:

Application forms P.1, P.2 and provisional specification and drawings of South African Patent No. 2003/9783 as originally filed in the Republic of South Africa on 18 December 2003 in the name of VAN STRAATEN WILLEM JOHANNES and an applicant substituted to GREENHOUSE INTERNATIONAL LLC on 16 February 2004 for an invention entitled: "OPTICAL APPARATUS"

Geteken te

PRETORIA

Signed at

in die Republiek van Suid-Afrika, hierdie


in the Republic of South Africa, this

dag van

10th

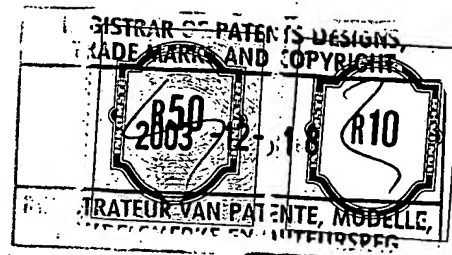
day of

March 2004


.....
Registrar of Patents

McCALLUM, RADEMEYER & FREIMOND
Ref: P20077

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978



APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT

The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate

Revenue Stamps or Revenue Franking
Machine Impression

OFFICIAL APPLICATION NO.

21 01 2003/9783

OFFICIAL DATE STAMP

FULL NAME(S) OF APPLICANT(S)

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TITLE OF INVENTION

54 OPTICAL APPARATUS

Priority is claimed as set out on the accompanying Form P2.

The earliest priority claimed is: NONE

This application is a patent of addition to Patent Application No.

21 01

This application is a fresh application in terms of section 37 and based on Application No.

21 01

THIS APPLICATION IS ACCOMPANIED BY:

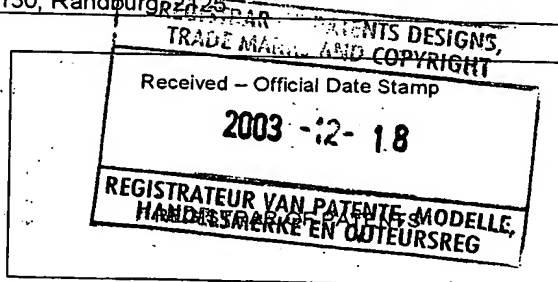
- ☒ 1 A single copy of a provisional specification of ...10... pages
- ☐ 2 Two copies of a complete specification of pages
- ☒ 3 ...2... Sheets of Informal Drawings
- ☐ 4 Sheets of Formal Drawings
- ☐ 5 Publication particulars and abstract (Form P8 in duplicate)
- ☐ 6 A copy of Figure of drawings (if any) for the abstract
- ☐ 7 Assignment of Invention
- ☐ 8 Certified priority document(s) Number(s)
- ☐ 9 Translation of priority document(s)
- ☐ 10 An assignment of priority rights
- ☐ 11 A copy of the Form P2 and the specification of SA Patent Application
- ☐ 12 A declaration and power of attorney on Form P3
- ☐ 13 Request for ante-dating on Form P4
- ☐ 14 Request for classification on Form P9
- ☒ 15 Form P2 in duplicate

21 01

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Dated 17 December 2003

McCALLUM, RADEMEYER & FREIMOND
PATENT AGENTS FOR APPLICANT(S)



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REGISTRAR OF PATENTS

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51		23			
Full name(s) of applicant(s)/Patentee(s)					
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Applicant(s) substituted:					
71	<i>Greenhouse International LLC</i>				Date Registered: <i>16.2.04</i>
Assignee(s):					
71					Date Registered:
Full name(s) of inventor(s)					
72	VAN STRAATEN, Willem Johannes				
Priority claimed					
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Use International		33	NONE	31	NONE
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Title of Invention:					
54	OPTICAL APPARATUS				
Address of applicant(s)/patentee(s)					
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Patent of Addition to Patent No.:		Date of any change:			
61					
Fresh Application based on:		Date of any change:			

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PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) – Regulation 27)

OFFICIAL APPLICATION NO

21	01 •	2003 / 9783
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LODGING DATE

22	18 December 2003
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FULL NAME(S) OF APPLICANT(S)

71	VAN STRAATEN, Willem Johannes
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FULL NAME(S) OF INVENTOR(S)

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TITLE OF INVENTION

54	OPTICAL APPARATUS
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BACKGROUND OF THE INVENTION

[0001] This invention relates to optical apparatus for creating an image against a background.

[0002] It is desirable in various situations to have an image which is superimposed against a background view. For example a golfer, addressing a ball, can be assisted in his stroke if an image, which is visible only to the golfer, is superimposed on his normal field of vision. This type of situation is described for example in the specification of international application No. PCT/IB02/00953.

[0003] There are similar situations in which a person can benefit. For example it is believed an archer can be assisted, particularly during training phases, by projecting an image over the archer's normal field of vision, which is visible to the archer, and which helps the archer when taking aim.

[0004] US patents Nos. 4806011 and 3498293 describe optical systems which project images of the kind referred to. The systems function satisfactorily but can be cumbersome to use. It is desirable to have a system which, as far as is possible, has the appearance of a normal pair of spectacles or sunglasses, which is not unreasonably bulky and which is relatively easy and inexpensive to manufacture.

SUMMARY OF INVENTION

[0005] The invention provides optical apparatus for creating a image on a background view which includes a first lens which is light transmissive and which has an outer reflective surface at an interface of a first surface of the lens with atmosphere and an inner reflective surface at an interface of a second surface of the lens with the atmosphere, and a device for projecting an image onto the outer reflective surface which is orientated to reflect a first image of the projected image, of a first light intensity, onto a first eye of a user and wherein the lens is made from a material of at least 80% absorption in the spectral range of 560nm to 660nm so that a second image of the projected image which is reflected onto the first eye by the inner reflective surface has a second intensity which is substantially less than the first intensity.

[0006] Preferably the lens material has between 80% to 85% absorption in the aforementioned spectral range which substantially corresponds to the spectral range to which the eye is most receptive. This will ensure a signal (first image) to noise (second image) ratio which is greater than 25:1.

[0007] According to a different aspect of the invention the lens is made from a material with a refractive index n and an absorption index A such that a light factor given by the expression $\left[1 - \left(\frac{n-1}{n+1}\right)^2\right]^2 (1-A)^2$ is less than 0.05.

[0008] Preferably the light factor is less than 0.03.

[0009] The apparatus preferably includes a second lens which is adjacent a second eye of the user and which has an absorption index which is substantially the same as the absorption index of the first lens.

5 [0010] The device which is used for projecting the image may be of any appropriate type. Although it falls within the scope of the invention for the device to be an active device and to make use of a light source which is powered by means of a battery it is preferable to make use of natural or ambient light only for this purpose. The device may thus include a shield with a light transmissive section or sections which define the image. The light
10 transmissive section or sections may comprise lines which define small openings in the shield. The light transmissive sections may be used together with a filter which may be variable or changeable thereby to change the colour of the image. This can be done to suit a user's requirements or to modify the light factor.

15 [0011] The shield and the lens may be shaped eg. curved, in an appropriate way to compensate for the lens shape so that the projected image, as seen by a user, includes straight lines.

[0012] If an active (battery-powered) image projection system is used then this, or at least the battery and the accompanying electronic components may
20 be removably engaged with the remainder of the apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention is further described by way of examples with reference to the accompanying drawings in which:

Figure 1 is a cross sectional view of a lens illustrating a principle upon which the apparatus of the invention is based;

Figure 2 is a plan view of optical apparatus, in the nature of a pair of spectacles, according to the invention;

Figure 3 is a side view of the apparatus of the invention; and

Figure 4 schematically depicts a variation of the invention.

DESCRIPTION OF PREFERRED EMBODIMENT

[0014] Figure 1 of the accompanying drawings illustrates in cross section a lens 10 used in the apparatus of the invention. The lens is made from a light transmissive material eg. glass or plastic, and has an outer reflective surface 12 and an inner reflective surface 14. The lens material has an absorption index A and a reflective index n .

[0015] Figure 1 illustrates an incident light ray I_1 impinging on the outer reflective surface 12. The ray produces a first reflected ray I_{R1} and a refracted ray I_{T1} . When the latter ray strikes the inner reflective surface 14 a ray I_{R2} is reflected internally and this is refracted at the interface of the outer surface 12 with atmosphere to produce a ray I_{T2} . At the interface of the inner surface with atmosphere an outgoing refracted ray I_{R3} is produced.

[0016] A person viewing the rays arising from the outer surface 12 will thus see, with an eye 18 a first, main image created by the ray I_{R1} and a second, lesser image created by the ray I_{T2} . The images are not coincident and consequently there is a blurring of the main image which is constituted by the ray I_{R1} . It is therefore desirable to make the intensity of the image constituted by the ray I_{T2} as small as possible relatively to the intensity of the main image created by the ray I_{R1} . This can be achieved by tinting the lens material, or by making use of a suitable material for the lens, so that the lens has between 80% to 85% absorption in the spectral range of 560nm to 660nm, parameters which ensure a signal (first image) to noise (second image) ratio which is greater than 25:1.

[0017] It can be shown that the ratio of the intensities of the two images, also referred to herein as a "light factor", is given by the expression

$$\frac{I_{T2}}{I_{R1}} = (1 - R)^2 (1 - A)^2,$$

where R = reflectance of the lens = $\left(\frac{n - 1}{n + 1}\right)^2$, and

A = absorption index of the lens material.

[0018] If the ratio is reduced sufficiently, eg. to less than 0.05, an eye of a user, viewing the images, adapts and "sees" one image only, namely the dominant image constituted by the ray I_{R1} . This aspect is further described hereinafter.

[0019] If the refractive index is too high then images passing through the lens from the normal field of vision to the eye of a user can be distorted. Consequently a practical restraint is placed on the refractive index. Thus to get the light factor as small as possible the absorption factor A must be increased. Again however a practical constraint arises in that if there the illumination intensities of two retinal images (the two eyes of a user) are unequal an undesirable effect known as the Pulfrich Phenomenon occurs. This phenomenon is noticeable if the difference between the amount of light entering the two eyes is about 12% or greater for image suppression takes place and binocular vision ceases.

[0020] Figure 2 illustrates in plan optical apparatus 20 according to the invention, which is in the nature of a pair of spectacles, and which is based on the aforementioned considerations.

[0021] The apparatus 20 includes a lens 22 which corresponds to the lens 10 shown in Figure 1, a second lens 24, a central nose piece 26, arms 28 and 30 which are engageable with the ears of a user in a known manner, and an image generating device 32.

[0022] The lens 24 is more or less at a right angle to the normal line of vision 34 of the left eye of a user who is wearing the apparatus. The lens 22 on the other hand is inclined to the normal line of vision 34A for the right eye. The inclination is such that, in relation to the image generating device 32, an image I which is projected onto the outer reflective surface 12 by the device is

directed (I_R and I_{T2}) onto the right eye of the user. Nonetheless the right eye is capable of looking through the lens 22 in a conventional manner, in the direction 34A, to view the background.

[0023] The device 32 has a small cup shaped cover 40 and a curved shield 42. A number of curved thin slots or apertures 44, in the nature of gridlines, are formed through the shield in a desired pattern. The pattern is chosen in a manner which is consistent with the way in which the apparatus 20 is to be used. The shield and the apertures are curved in a manner which is dependent on the curvature of the lens so that an image projected by the device 32 onto the lens 22 includes straight (not curved) lines. The device 32 may optionally include one or more removable filters 46 which can be inserted into the cover at a position at which the filter is adjacent the shield. The filter can for example be made from a suitably coloured plastics material. The arrangement is such that, with the filter in place, light of a particular colour passes through the gridline apertures 44 and, as noted, the colour can be chosen according to requirement. The use of the filter is optional for, in the absence of the filter, the light which passes through the gridline apertures is white light ie. natural light from the atmosphere.

[0024] The lens 22 is for all practical purposes the same as the lens 10 and is of substantially uniform thickness. The lens has an absorption index A and the lens 34 has a similar absorption index. Consequently the lenses transmit light of substantially the same intensity to the respective eyes of the user and the Pulfrich Phenomenon is avoided.

[0025] In a practical can the lenses 22 and 24 are made from polycarbonate with a refractive index $n = 1.184$.

The light factor is given by the expression $\frac{I_{T2}}{I_{R1}} = (1 - R)^2 (1 - A)^2$,

where $A = 0,85$ at least for the spectral range of 560nm to 660nm and
 5 $R = 0,0513$

Thus $\frac{I_{T2}}{I_{R1}} = (1 - 0,0513)^2 (1 - 0,85)^2 = 0,02$

The image I_{R1} has an intensity of 5,13% of the intensity of the incident ray I_1 , and the image I_{T2} has an intensity of $0,02 \times 5,13 = 0,1\%$ of the intensity of the incident ray.

10 **[0026]** The image generation device 32 is used to project an image of a desired pattern onto the outer surface 12 of the lens and this is reflected as two images corresponding to the light rays I_{R1} and I_{T2} respectively, referred to in connection with Figure 1, onto the right eye of the user. In the illustrated example only the right eye sees the image. Nonetheless the brain is capable
 15 of superimposing the projected image onto the normal field of vision, seen with both eyes (34 and 34A), and the user is unaware that one eye only is seeing the image. As the lenses 22 and 24 have substantially the same absorption index binocular vision is retained.

20 **[0027]** The image which is generated by the device 32 can be varied according to requirement and the colour thereof can be changed in an easy manner simply by changing the filter 46.

[0028] The device 32 makes use of ambient light to project the desired image onto the lens 22. It is possible to replace the device 32 with an active device 50, see Figure 4, which includes a light source such as an LED 52 and a small battery 54 which powers the LED. Light 56 from the source then passes through a grid or pattern 58 on a shield 60 and the image 62 which is formed thereby is projected onto the lens 22. The device 50 may be removably attached to a suitable spectacle frame.

Dated this 17th day of December 2003.



McCALLUM, RADEMEYER & FREIMOND
Patent Agents for the Applicant

• • 2003 / 9783

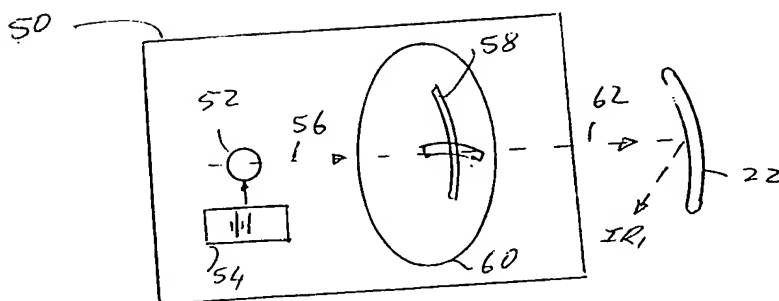
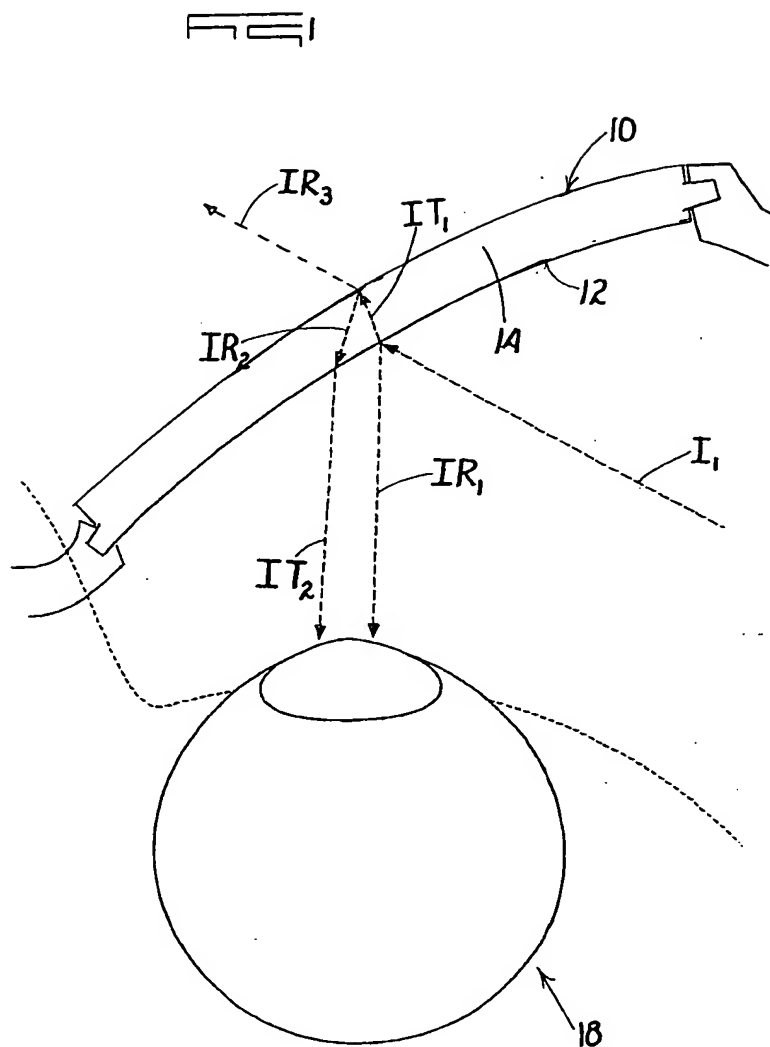
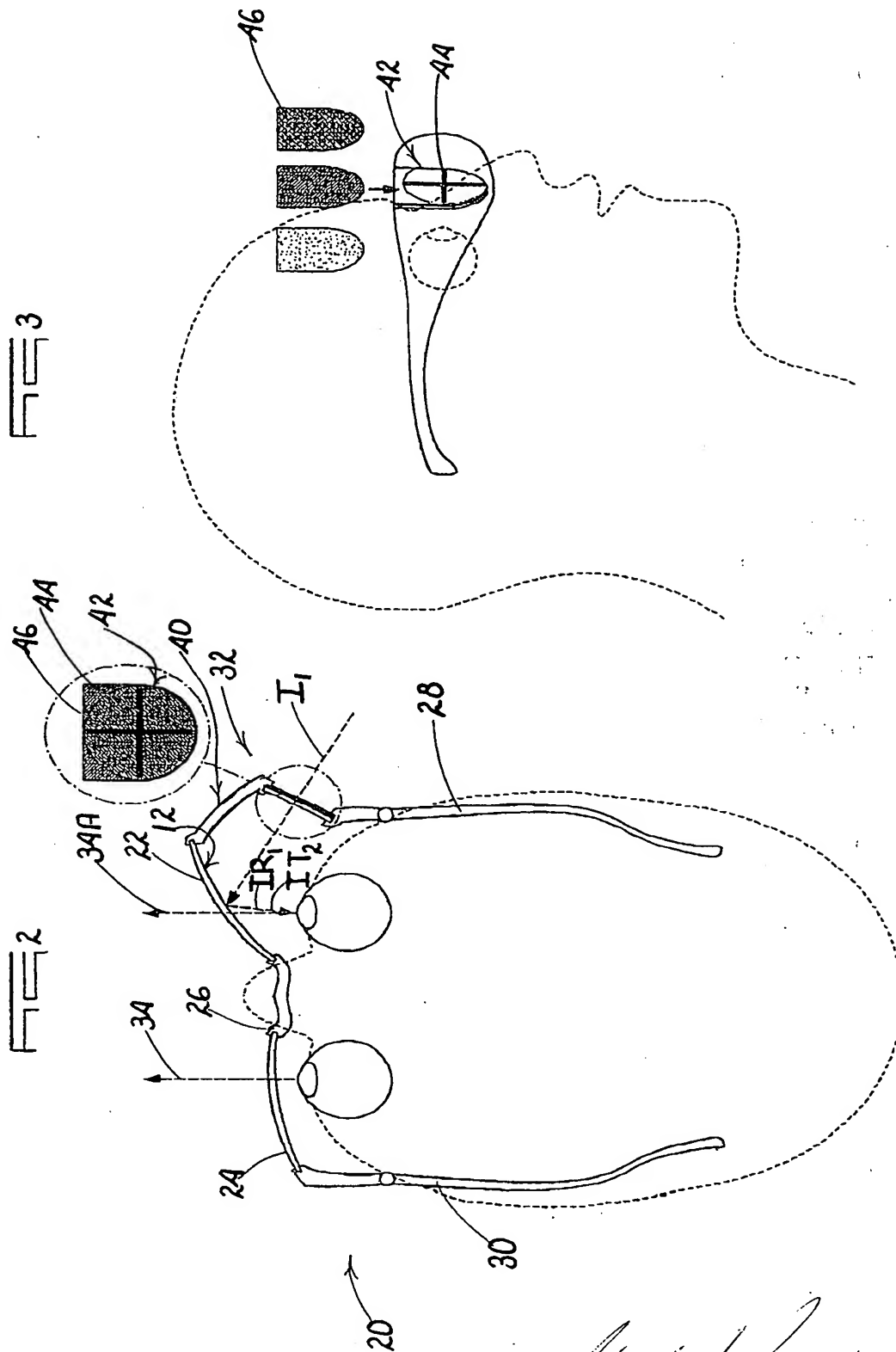


Fig 4

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